REMARKS

Claims 1, 13-16, 18, 19, and 25-61 are currently pending. Claims 19 and 46 have been amended. It is respectfully submitted that no new matter has been added.

The Patent Office rejected claims 19 and 45 under 35 U.S.C. 112, second paragraph, as being indefinite.

Claim 19 has been amended to recite the "detected transmission mode" since the means for detecting will detect either the first transmission mode or the second transmission mode and processing of the second signal will be in accordance with the detected transmission mode.

Claim 46 has been amended to change its dependency from claim 25 to claim 45 (it is claim 46 that is believed to be the claim in question, not claim 45).

It is respectfully submitted that no new matter has been added and it is respectfully requested that the Patent Office withdraw its rejection of claims 19 and 46 (not 45) under 35 U.S.C. 112, second paragraph.

Applicant thanks the Patent Office for its indication that claims 13-16, 18, 19, and 61 are allowed and its indication that claims 37, 41, 56, and 60 recite patentable subject matter. However, Applicant believes that all pending claims are in condition for allowance.

The Patent Office rejected claims 1, 29-31, 40, 42, 43, 48-50, and 59 under 35 U.S.C. 102(b) as being anticipated by Zhang, "Reduced-State MIMO sequence estimation for EDGE systems," Signals, Systems and Computers, 2002, Conference Record of the Thirty-Sixth Asilomar Conference, 3-6 Nov. 2002, volume 1, pages 541-545.

For a claim to be anticipated, each and every non-inherent claim limitation must be taught in a single reference (from MPEP 2131).

Claim 1 recites as follows:

> receiving a wireless communication signal from at least two spatially separated transmit antennas associated with at least one transmitter or from at least two transmitters; and
>
> performing on a corresponding complex composite base band received signal, comprised of real modulation signals, complex modulation signals or a combination of real and complex modulation signals, **joint pre-filtering and reduced state sequence detection of real and imaginary parts of signals**, from

> a single receive antenna branch or from a plurality of receive antenna branches, **separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches.**

The other rejected independent claim, claim 42, recites subject matter similar to that of claim 1.

The applicants point out that exemplary embodiments of this invention enable **the splitting of a complex baseband signal, including a sum of PAM (real modulation) and QAM (complex modulation) signals**, where two copies of the signal are derived. Unlike conventional approaches that may deal with the PAM signal only, in this case the equivalent channel for the PAM signal has a vector form, while the equivalent channel fro the QAM signal has a matrix form (since the real and imaginary parts of the QAM signal form a vector modulation). As a result, even with a single receive antenna one can obtain a MIMO system model (which should not be confused with conventional MIMO systems where signals are treated as basic complex quantities and multiple receive antennas are essential for generating the MIMO model). In accordance with the exemplary embodiments of this invention signal detection may be performed using joint pre-filtering and sequence detection of real and imaginary parts of the modulation signals separately, while filtering out the noise-plus-residual interference across inphase and quadrature branches. The enhanced receiver and method may be implemented using a single receive antenna, unlike traditional MIMO receivers where multiple antennas are needed. The additional of one or more further receive antennas simply enhances the performance.

The Applicants note further that exemplary embodiments of this invention pertain at least in part to several possible cases and scenarios. These exemplary embodiments are not meant to be limiting, but have been provided merely for illustration.

A) A base station has at least two antennas that may transmit any combination of GMSK and 8-PSK signaling formats. At the receiver (having one or more receive antennas) I-Q MIMO processing is applied using singe/multiple receiver antennas. If both modulation formats are coming from the same base station the receiver may process both data streams after detection.

B) In another scenario there are multiple base stations that transmit simultaneously causing interference to each other. Each base station has one antenna (even if there are two

antennas, one may assume that there is only one modulation signal (GMSK/8PSK) coming from this base station). Now the received signal contains the desired signal (with GMSK/8-PSK) and interference coming from possibly many other base stations whose modulation may be GMSK/8PSK. The receiver (having one or more receive antennas) applies I-Q MIMO detection by estimating the channel impulse response and modulation type parameters from the desired and dominant interfering base stations. The residual interference may be treated as background noise.

In general, the receiver may be configured in at least two modes:

A) Joint I-Q MIMO detection receiver that detects the data of signal and interference but discards the interfering symbols; and

B) Blind I-Q single user detection where the receiver detects the desired signal (e.g. 8-PSK) in I-Q space while treating all interference as background noise.

Applicant discloses in paragraph 0056 as follows: "We note the difference between the novel branch metric above made up with I-Q parts of the composite signals, and a conventional branch metric defined using complex quantities."

Zhang does not appear to disclose separation of a received signal into in-phase and quadrature branches. Although Figure 1 of Zhang shows a Joint MIMO Feedforward Filter, Zhang does not disclose or suggest "**reduced state sequence detection of real and imaginary parts of signals… separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches**" or "**joint pre-filtering … of real and imaginary parts of signals… separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches.**"

Because Zhang does not disclose this claimed subject matter and because this claimed subject matter is not inherent, Zhang does not anticipate claims 1, 29-31, 40, 42, 43, 48-50, and 59.

The Patent Office rejected claims 25-28 and 44-47 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of Onggosanusi, U.S. Published Patent Application No. 2004/0192215.

The Patent Office asserted on page 6, line 18, through page 7, line 8, of the Final Office Action dated October 30 2007 as follows:

> Re claim 25, Zhang fails to teach a method where the real modulation signal is a GMSK signal, and where receiving includes rotating the received signals in complex space such that the GMSK signal is binary modulate. However Onggosanusi teaches where the real modulation signal is a GMSK signal (¶0039-¶0040, ¶0045), and where receiving includes rotating the received signals in complex space (block 510 in fig. 5, ¶0044) such the GMSK signal is binary modulated (¶0040-¶0043. a_k is modulated using binary phase shift keying). Therefore taking the combined teachings of Zhang and Onggosanusi as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the method of Onggosanusi into the method of Zhang. The motivation to combine Onggosanusi and Zhang would be to provide an additional degree of freedom to assist in interference cancellation (¶0042).

Zhang does not appear to disclose separation of a received signal into in-phase and quadrature components and does not express a need or desire to do such. Like Zhang, Onggosanusi does not disclose or suggest "**reduced state sequence detection of real and imaginary parts of signals… separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches.**"

Thus, claims 25-28 and 44-47 are not made obvious by Zhang in view of Onggosanusi.

The Patent Office rejected claims 32, 33, 36, 38, 51, 52, 55, and 57 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of Olsson, U.S. Published Patent Application No. 2005/0111596.

The Patent Office asserted on page 9, line 10, through page 10, line 2, of the Final Office Action dated October 30, 2007, as follows:

> Re claim 32, Zhang fails to teach a method configured in a 8PSK blind I-Q interference suppression receiver when a GMSK interferer is present. However Olsson teaches a method configured in an 8PSK blind I-Q interference suppression receiver (¶0042-¶0043, the blind modulation detection of a desired signal. Also in an EDGE system, signals of either GMSK or 8PSK modulation are present) when a GMSK interferer is present (¶0043, an interferer is GMSK-modulated). Therefore taking the combined teachings of Zhang and Olsson as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was

> made to incorporate the method of Olsson into the method of Zhang. The motivation to combine Olsson and Zhang would be to give a smaller residual error after channel estimation, compared to a conventional receiver (¶0043).

Although Olsson discloses in the related art section a SAIR algorithm to estimate in-phase/ quadrature correlation, Olsson, like Zhang, does not disclose or suggest "**reduced state sequence detection of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches**" or "**joint pre-filtering ... of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches.**"

As Olsson, like Zhang, does not disclose or suggest "reduced state sequence detection of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches" or "joint pre-filtering ... of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches," claims 32, 33, 36, 38, 51, 52, 55, and 57 are allowable over Zhang in view of Olsson.

The Patent Office rejected claims 34, 35, 53, and 54 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of Olsson and further in view of Onggosanusi.

For at least the reason that Zhang, Olsson, and Onggosanusi each do not disclose or suggest "**reduced state sequence detection of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches,**" claims 34, 35, 53, and 54 are allowable over these references.

The Patent Office rejected claims 39 and 58 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of Olsson and further in view of Hafeez, U.S. Patent No. 6,304,618.

Hafeez does not disclose in-phase and quadrature branches.

As Hafeez, like Olsson and Zhang, does not disclose or suggest "reduced state sequence detection of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches" or "joint pre-filtering ... of real and imaginary parts of signals... separately to filter out noise plus residual interference across inphase (I) and quadrature (Q) branches," claims 39 and 58 are allowable over Zhang in view of Olsson.

The Patent Office is respectfully requested to reconsider and remove the rejections of the claims 1 and 25-60 under 35 U.S.C. 102(b) based on Zhang or under 35 U.S.C. 103(a) based on Zhang in view of Onggosanusi, Olsson, and/or Hafeez, and to allow all of the pending claims 1, 13-16, 18, 19, and 25-61 as now presented for examination. An early notification of the allowability of claims 1, 13-16, 18, 19, and 25-61 is earnestly solicited.

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Respectfully submitted:

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